polarization direction of at least one color component out of the image light irradiated onto the screen is parallel to a vertical cross section of the screen.

Claim 14, upon which claims 15-26 are dependent, recites a rear projection device similar to the device recited in claim 1 with the exception that the projection means for projecting image light is color-synthesized by the color synthesizing means on a screen from a slant side. Also, the polarization direction of at least one color component out of the image light irradiated on the screen is parallel to a horizontal cross section of the screen.

Claim 27, upon which claims 28-38 are dependent, recites a rear projection display device similar to the display device recited in claim 1 with the exception that the projection means slantly projects image light which is color-synthesized by the color synthesizing means on a screen. The polarization direction of at least one color component out of the image light irradiated on the screen is parallel to a plane including the image light irradiated on the screen in a normal of the screen.

According to the claimed configuration, provided is a rear projection display device which enables an observer to observe a picture on the front surface of a screen by projecting image light onto the back surface of the screen from a slant. The claimed rear projection device is capable of improving the brightness and the image quality of the picture by improving the utilization efficiency of the image light which is projected onto the screen from a slanted angle. Thus, one unobvious advantage of the claimed invention is that the brightness and the image quality is increased by providing the polarization direction of the green component in a parallel direction to the vertical cross section of the screen. It is respectfully submitted that the prior art fails to disclose or suggest each element of the presently pending claims, and therefore, fails to provide the advantages which are provided by the claimed invention.

Shikama discloses a projector 300 comprising a light source 1 with lamp 120 and parabolic mirror 130 that directs white light toward dichroic mirrors 14B and 14G. The projector 300 also comprises mirrors 11a, 11b and 11c, liquid crystal display panels 3R, 3G and 3B, a dichroic prism 15, a projection lens 4, and a reflecting, front projection screen 5F. The lamp 120 is at the focal point of the parabolic mirror 130 to produce a

collimated beam of white light. The dichroic mirror 14B transmits red and green light, but reflects blue light. The dichroic mirror 14G reflects green light but transmits red light. By means of the dichroic mirrors 14B and 14G, white light 2 is decomposed into three primary colors. The mirrors 11A and 11B reflect red light, the dichroic mirror 14B and the mirror 11C reflect blue light, and the dichroic mirror 14G reflects green light. The reflected light is directed to the respective one of the liquid crystal display panel 3R, 3G and 3B, each of which produces a monochromatic image of the respective color under control of an operating circuit.

Applicants respectfully submit that each and every element recited within claims 1, 14 and 27 of the present application is neither disclosed nor suggested by the cited prior art. In particular, Applicants respectfully submit that the rear projection display device claimed in the present application is clearly distinct from that which is illustrated in Shikama. Specifically, it is submitted that Shikama fails to disclose or suggest at least the following limitation recited in the claims.

Claim 1. ...wherein a polarization direction of at least one color component out of the image light irradiated on the screen is parallel to a vertical cross section of the screen.

Claim 14. ...wherein a polarization direction of at least one color component out of the image light irradiated on the screen is parallel to a horizontal cross section of the screen.

Claim 27. ...wherein a polarization direction of at least one color component out of the image light irradiated on the screen is parallel to a plane including the image light irradiated on the screen and a normal of the screen.

Although Shikama discloses a projecting method for a picture display apparatus having three crystal panels and a dichrolic prism, Applicants respectfully submit that

Shikama nevertheless fails to disclose or suggest that the polarization directions of the red, green and blue primary color lights emitted from each of the liquid crystal panels are adjusted in correlation to the fresnel lens screen as recited in the present claims.

As discussed in the specification of the present application, the spectral luminous efficiency of a man's eyes is the highest at around a wavelength of 555 nm which corresponds to a color of green, and therefore a man is more likely to recognize green light being brighter in comparison with red and blue light. As a result, when the image light is projected by using the conventional projection unit 120, the reflectivity of the brightest green light at the screen 120 increases, and the brightness as a whole is lowered. Furthermore, the image quality is degraded because of the reflected light. Applicants submit that the presently claimed invention which recites at least the subject matter in foregoing limitations resolves the problems caused by the conventional projection unit 120.

Accordingly, Applicants respectfully submit that Shikama fails to disclose or suggest each and every element recited in claims 1, 14 and 27 of the present application. Applicants respectfully request the withdrawal of the rejection of claims 1, 14 and 27.

In addition, Applicants submit that the Office Action is improper since the Office Action failed to address Applicants' arguments in the response of June 8, 2001 that Shikama fails to disclose or suggest the foregoing limitations recited in the claims. Pursuant to MPEP § 707.07(f), "[w]here the requirements are traversed, ... the examiner should make proper reference thereto in his or her action on the amendment. Where the applicant traverses any rejection, the examiner should, if he or she repeats the rejection, take note of the applicant's argument and answer the substance of it." (Emphasis Added).

In Applicants' response filed June 8, 2001, Applicants traversed the rejection of claims 1, 14 and 27 under 35 U.S.C. § 102(b) as being anticipated by Shikama on the basis that Shikama fails to disclose or suggest a polarization direction of at least one color component out of the image light irradiated on the screen that is parallel to a vertical cross section of the screen, or is parallel to a horizontal cross section of the

screen, or is parallel to a plane including the image light irradiated on the screen and a normal of the screen. In the Office Action of October 23, 2001, claims 1, 14 and 27 were again rejected under 35 U.S.C. § 102(b) as being anticipated by Shikama. However, Applicants submit that nowhere does the Examiner address how or where Shikama teaches each and every limitation discussed above. In fact, Applicants submit that the Office Action fails to answer the substance of Applicant's argument in accordance with the requirements of MPEP § 707.07(f), that Shikama fails to disclose or suggest a polarization direction of at least one color component out of the image light irradiated on the screen that is parallel to a vertical cross section of the screen, or is parallel to a horizontal cross section of the screen, or is parallel to a plane including the image light irradiated on the screen and a normal of the screen. Accordingly, Applicants respectfully submit that the rejection with respect to claims 1, 14 and 27 is improper and respectfully request the withdrawal thereof.

Claims 2-8, 11, 13, 15-21, 24, 26, 28-33, 36 and 38 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Shikama in view of Jachimowicz et al. (U.S. Patent No. 4,995,718, hereinafter "Jachimowicz"). In making this rejection, the Office Action took the position that Shikama disclosed each and every claimed element with the exception of showing a retardation plate. The Office Action cited Jachimowicz for curing the deficiencies that exist in Shikama. Applicants respectfully traverse this rejection, and submit that each of these claims recites subject matter which is neither disclosed nor suggested in the prior art.

Jachimowicz discloses a full color three-dimensional projection display having electrically controllable half wave plate or retarder (ECR) 46 and a quarter wave retarder 48.

Applicants submit that each of claims 2-8, 11, 13, 15-21, 24, 26, 28-33, 36 and 38 also recites subject matter which is neither disclosed nor suggested by Shikama in view of Jachimowicz. In particular, each of claims 2-8, 11, 13, 15-21, 24, 26, 28-33, 36 and 38 are dependent claims dependent from independent claims 1, 14 and 27, respectively. Therefore, each of these dependent claims incorporates each and every limitation recited within independent claims 1, 14 and 27, therein, respectively. It is

submitted that Jachimowicz fails to disclose or suggest the deficient limitations noted above with respect to Shikama. Therefore, Applicants submit that each of claims 2-8, 11, 13, 15-21, 24, 26, 28-33, 36 and 38 also recites subject matter which is neither disclosed nor suggested by Shikama and/or Jachimowicz, taken alone or in combination, for at least the reasons set forth above with respect to claims 1, 14 and 27. Applicants respectfully request the withdrawal of the rejection of these claims.

Claims 9, 10, 12, 22, 23, 25, 34, 35 and 37 were rejected under 35 U.S.C. §103(a) as being unpatentable over Shikama in view of Shibazaki (U.S. Patent No. 5,477,394). In making this rejection, the Office Action took the position that Shikama disclosed all of the elements of the claimed invention with the exception of showing a plurality of aspherical mirrors as recited in the claims. Shibazaki was cited for curing the deficiencies that exist in Shikama. Applicants respectfully traverse this rejection, and submit that each of these claims recites subject matter which is neither disclosed nor suggested in the prior art.

Shibazaki discloses a projector comprising a light valve 12, a converging lens 13, a plane mirror 14, an elliptical mirror 15, a projection lens 16, a parabolic mirror 17, a Fresnel lens 18 and a lenticular lens-screen 19. The elliptical mirror 15 of Shibazaki has a primary focal point F1 and a secondary focal point F2 that is also a focal point of the parabolic mirror 17.

Applicants respectfully submit that each and every element recited within each of claims 9, 10, 12, 22, 23, 25, 34, 35 and 37 is neither disclosed nor suggested by Shikama, and/or Shibazaki, taken alone or in combination. In particular, each of claims 9, 10, 12, 22, 23, 25, 34, 35 and 37 depends from independent claims 1, 14 and 27, respectively, and therefore, each and every limitation recited within the independent claims, is also recited within dependent claims 9, 10, 12, 22, 23, 25, 34, 35 and 37. As such, these dependent claims incorporate the limitation of a polarization direction of at least one color component out of the image light irradiated onto the screen, and is parallel to a vertical cross-section of the screen, or is parallel to a horizontal cross-section of the screen, or is parallel to a plane, including the image light irradiated on the screen and a normal of the screen, respectively. Upon review of Shibazaki, it is

respectfully submitted that Shibazaki fails to disclose and suggest the elements above, and therefore, fails to cure the deficiencies which exist in Shikama. Thus, Applicants respectfully that neither Shikama nor Shibazaki, taken alone or in combination, disclose or suggest each and every element recited within claims 9, 10, 12, 22, 23, 25, 34, 35 and 37 of the present application.

In view of the above, Applicants respectfully submit that claims 1-38, each recites subject matter that is neither disclosed nor suggested in the cited prior art. Applicants also submit that the differences between the subject matter and the prior art relied upon, is more than sufficient to render claims non-obvious to a person of ordinary skill in the art, and therefore, respectfully request that claims 1-38 be found allowable, and this application be passed to issue.

If for any reason the Examiner determines that the application is not now in condition for allowance, it is respectfully requested that the Examiner contact by telephone the Applicants' undersigned attorney at the indicated telephone number to arrange for an interview to expedite the disposition of this application.

In the event this paper is not being timely filed, the Applicants respectfully petition for an appropriate Extension of Time. Any fees for such an extension, together with any additional fees, may be charged to counsel's Deposit Account Number 01-2300.

Respectfully submitted,

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Enclosures: Petition for Extension of Time (3 months)
Marked-Up Version of Claims and Specification

Marked-Up Copy of Original Claim 3

3. (Amended) The rear projection display device according to claim 1, wherein the polarization direction of at least the green component out of the image light irradiated on the screen is parallel to the vertical cross section of the screen [at least one of the color components is green].

MARKED-UP VERSION OF ORIGINAL SPECIFICATION

Page 3, second paragraph:

The S-polarized light is a linearly polarized light wherein the oscillation direction of the electric vector of the light incident to a sample surface, is vertical to a surface including a normal of the sample surface and a normal of a wave surface which is a light traveling direction. The P-polarized light is a linearly polarized light wherein the oscillation direction of the electric vector of the light incident to a sample surface, is included in an incident surface (a surface including a normal of the sample surface and a light traveling direction).

Page 6, first paragraph:

When image light is projected onto a screen either from slanting above or from slanting below, an angle, which is formed by a principal ray of light incident to the screen and a normal of the screen, is larger in a vertical direction than in a horizontal direction. Therefore, when a polarization direction of a green component, of which spectral luminous efficiency for a man's eyes is high, is made parallel to a vertical cross section of the screen, less image light is reflected and lost on a back surface of the screen.

Page 7, third paragraph:

When image light is projected onto a screen on a slant, an angle, which is formed by a principal ray of light incident to the screen and a normal of the screen, is larger in a horizontal direction than in a vertical direction. Therefore, when a polarization direction of a green component, of which spectral luminous efficiency for a man's eyes is high, is made parallel to a horizontal cross section of the screen, less image light is reflected and lost on a back surface of the screen.

Page 9, third paragraph:

When image light is projected onto a screen on a slant, an angle, which is formed by a principal ray of light incident to the screen and a normal of the screen is maximum in a

plane including the image light irradiated on the screen and a normal of the screen. Therefore, when a polarization direction of a green component, of which spectral luminous efficiency for a man's eyes is high, is made parallel to the plane including the image light irradiated on the screen and a normal of the screen, less image light is reflected and lost on a back surface of the screen.

Page 10, second paragraph:

This structure ensures that a color component of which a polarization direction is orthogonal with a plane which includes image light irradiated on the screen and a normal of the screen out of the image light synthesized by the color synthesizing means, is selectively adjusted so that the color component is made parallel to a plane which includes the image light irradiated on the screen and the normal of the screen.

Page 10, third paragraph:

It is preferred that the polarization directions of all the color components of the image light irradiated on the screen are parallel to a plane which includes the image light irradiated on the screen and a normal of the screen (i.e., a perpendicular line to the screen).

Page 10, fourth paragraph:

A polarization direction adjusting means is provided for selectively adjusting a color component from the image light synthesized by the color synthesizing means so that the polarization direction of the color component is parallel to the plane including the image light irradiated on the screen and a normal of the screen. The polarization direction is orthogonal with the plane which includes the image light irradiated on the screen and the normal screen.

Page 11, first complete paragraph:

This structure ensures that a color component of which a polarization direction is orthogonal with a plane which includes image light irradiated on the screen and a

normal of the screen out of the image light synthesized by the color synthesizing means, and is selectively adjusted so that the color component is made parallel to a plane which includes the image light irradiated on the screen and the normal of the screen (i.e., a perpendicular line to the screen).

Page 11, third paragraph:

In a rear projection display device of this invention, the relation j-min$<\beta<$j-max is satisfied, wherein an angle of a maximum value (j-max) and a minimum value (j-min) are formed by a normal of a front surface of the screen and by a principal ray of the image light irradiated on the front surface of the screen, and an angle β is obtained when the reflectivity of light, having a polarization direction parallel to the vertical cross section of the screen, to the front surface of the screen is at a minimum.

Page 12, first paragraph:

In this structure, light having a polarization direction parallel to a vertical cross section of a screen is irradiated on a back surface of the screen at an angle α at which the reflectivity to a normal of a back surface of the screen is low.

Page 12, second paragraph:

In a rear projection display device of this invention, the relation j-min$<\beta<$j-max is satisfied, wherein an angle of a maximum value (j-max) and a minimum value (j-min) are formed by a normal of a front surface of the screen and by a principal ray of the image light irradiated on the front surface of the screen, and an angle β is obtained when the reflectivity of light, having a polarization direction parallel to the vertical cross section of the screen, to the front surface of the screen is at a minimum.

Page 13, second paragraph:

In a rear projection display device of this invention which image light is irradiated onto the back surface of the screen from a slant, and a picture is observed from the front surface of the screen, the relationship of i-min$<\alpha<$i-max is satisfied, where an angle of a

maximum value (i-max) and a minimum value (i-min) is formed by a normal of the back surface of the screen and by a principal ray of the image light irradiated on the back surface of the screen. The angle α is obtained when the reflectivity of light, having a polarization direction parallel to the horizontal cross section of the screen, to the back surface of the screen is at a minimum.

Page 13, third paragraph:

In this structure, light having a polarization direction parallel to a horizontal cross section of a screen is irradiated onto a back surface of the screen at an angle including the α angle at which the reflectivity to a normal of a back surface of the screen of a back surface of the screen is low.

Page 14, first paragraph:

In a rear projection display device of this invention, the relation $j\text{-min}<\beta<j\text{-max}$ is satisfied, where an angle of a maximum value (j-max) and a minimum value (j-min) is formed by a normal of the front surface of the screen and by a principal ray of the image light irradiated on the front surface of the screen. The angle β is obtained when the reflectivity of light, having a polarization direction parallel to the horizontal cross section of the screen, to the front surface of the screen is at a minimum.

Page 14, second paragraph:

In this structure, light having a polarization direction parallel to a horizontal cross section of a screen is irradiated onto a front surface of the screen at an angle including the angle β at which the reflectivity to a normal of the back surface of the screen of the back surface is low.

Page 15, first paragraph:

In a rear projection display device of this invention, the relationship of $j\text{-min}<\beta<j\text{-max}$ is satisfied, where an angle of a maximum value (j-max) and a minimum value (j-min) is formed by a normal of a front surface of the screen and by a principal ray of the image

light irradiated onto the front surface of the screen. The angle β is obtained when the reflectivity of light, having a polarization direction parallel to a plane including image light irradiated onto the front surface of the screen and [onto] a normal of the front surface of the screen, to the front surface of the screen is minimum.

Page 15, second paragraph:

In this structure, light having a polarization direction parallel to a plane including image light irradiated onto the front surface of the screen and onto a normal of a front surface of the screen is irradiated at an angle including the angle β at which the reflectivity to a normal of a front surface of the screen at the front surface of the screen is low.

Page 15, third paragraph:

In a rear projection display device of this invention, the relationship of j-min < β < j-max is satisfied, where an angle of a maximum value (j-max) and a minimum value (j-min) is formed by a normal of the front surface of the screen and by a principal ray of the image light irradiated onto the front surface of the screen. The angle β is obtained when the reflectivity of light, having a polarization direction parallel to the plane including image light irradiated onto the front surface of the screen and onto a normal of the front surface of the screen, to the front surface of the screen is minimum.

Page 16, first paragraph:

In this structure, light having a polarization direction parallel to a plane including image light irradiated onto the front surface of the screen and [onto] a normal of the front surface of the screen is irradiated on a front surface of the screen at an angle including the angle β at which the reflectivity to a normal of a front surface of the screen at the front surface of the screen is low.

Page 16, third paragraph:

The polarization direction of at least the green component from the image light irradiated onto the screen is parallel to a plane including image light irradiated onto [the] a back surface of the screen and onto a normal of the back surface of the screen.

Page 16, fourth paragraph:

When a polarization direction of the green component is made parallel to a plane including image light irradiated onto the front surface of the screen and [onto] a normal of the front surface of the screen, less image light is reflected and lost on a back surface of the screen.

Page 18, third paragraph:

An image forming system is composed of the first-third mirrors 3-5. The first mirror 3 has an aspherical concave shape, the second and third mirrors 4, 5 have aspherical convex shapes. The shapes of the mirrors in the image forming system ensure corrections of aberration, such as astigmatism, coma, and also ensure magnifications of the image light. The image light emitted from the projection unit 2 is successively reflected on the first-third mirrors 3-5, and is irradiated on the fourth mirror 6 which is arranged on the internal back surface of the body 1. The image light irradiated on the fourth mirror 6, which is of a flat plate shape, is irradiated from slantly behind on a back surface of the screen 7 which is arranged on a front opening of the body 1. A picture is thereby formed.

Page 22, first paragraph:

As shown in Fig. 1, the image light transmitted through the λ /2 retardation plate 29 is successively reflected on the first-third mirrors 3-5 which compose the image forming system, and is irradiated to the fourth mirror 6 arranged on the back surface of the body 1. The shapes of the mirrors in the image forming system ensure corrections of aberration, such as astigmatism, coma, and also ensure magnification of the image light.

Page 25, third paragraph:

An angle (i) is formed by a principal ray of the image light irradiated onto the screen 7 and [onto] the normal A of the screen 7. The angle (i) is set to satisfy the below expression 2. Therefore, the utilization efficiency of P-polarized light component can be improved, leading to higher brightness.

Page 26, second paragraph:

An angle of an inclined surface 71b is set so that an angle (j), which is formed by a normal B to the inclined surface 71b of the fresnel lens screen 71 and a principal ray of the image light irradiated to the screen 71, is j-max at maximum and j-min at minimum on each protruded inclined surface 71b of the fresnel lens screen 71. In this embodiment, an inclination τ of each inclined surface 71b is set so that j-max is 38.36° and j-min is 22.57°.

Page 28, first paragraph:

An angle (j), which is formed by the principal ray of the image light irradiated onto the inclined surface 71b of the screen 7 and [onto] the normal B of the inclined surface 71b, [which] satisfies the expression 3 below. Therefore, the light utilization efficiency of P-polarized light component itself can be improved, leading to higher brightness.